

What is claimed is:

1. A signature simulator comprising:

a ground truth tool comprising:

a first input of atmosphere conditions; and

a second input of field data; and

an output of selected data; and

a simulation module comprising:

a first input of an agent absorption coefficient;

a second input of system performance

requirements; and

an output.

2. The simulator of claim 1, further comprising:

a training data module comprising:

an input connected to the output of the

simulation module; and

an output.

a sequestered test data module comprising:

an input connected to the output of the  
simulation module and;  
an output.

3. The simulator of claim 2, further comprising an  
algorithm development module comprising:

a first input connected the output of the training  
data module;  
a second input; and  
an output.

4. The simulator of claim 3, further comprising a  
detection performance test and evaluation module  
comprising:

a first input connected to the output of the  
sequestered test data module;  
a second input connected to the output of the  
algorithm development module; and  
an output connected to the second input of the  
algorithm development module.

5. A simulation system comprising:

an atmospheric radiance and transmission modeling  
module;

an atmospheric conditions source connected to the  
atmospheric radiance and transmission modeling  
module;

a sensor response removal module;

a field data source connected to the sensor response  
removal module;

a sensor response source connected to the sensor  
response removal module;

a special characteristics addition module connected to  
the sensor response removal module;

an atmospheric attenuation module connected to the  
atmospheric radiance and transmission modeling  
module and to the special characteristics  
addition module; and

a sensor response addition module connected to the  
sensor response source and to the atmospheric  
attenuation module.

6. The system of claim 5, wherein the sensor response  
addition has a simulated data output.

7. A simulator system comprising:

a chemical agent detection environment simulation  
device;

a user interface connected to the chemical agent  
detection environment simulation device;

a background measurement environment interferogram  
source connected to the chemical agent detection  
environment simulation device;

a numerical computing tool connected to the chemical  
agent detection environment simulation device;  
and

an atmospheric transmittance and radiance model  
connected to the chemical agent detection  
environmental simulation device.

8. The system of claim 7, further comprising an ancillary  
information source connected to the chemical agent  
detection environment simulation device.

9. The system of claim 8, wherein:

files may be input to the atmospheric transmittance  
and radiance model from the chemical agent  
detection simulation device environment; and  
atmospheric model information may be input to the  
chemical agent detection environment simulation  
device from the atmospheric transmittance and  
radiance model.

10. A simulation method comprising:

computing parameters of a plurality of parameters of  
spectrums;

calibrating a background spectrum;

constructing an atmospheric model;

construction a cloud model; and

building simulated spectra from the plurality of

parameters of spectrums, the background spectrum,

the atmospheric model and the cloud model.

11. The method of claim 10 further comprising signal-to-noise compensation of the simulated spectrum.

12. A means for simulating comprising:

means for computing parameters for at least one spectrum;

means for calibrating a background spectrum;

means for constructing an atmospheric model;

means for constructing a cloud model;

means for simulating a signature from the at least one spectrum, the background spectrum, the atmospheric model and the cloud model.

13. The means of claim 12, further comprising a means for improving a signal-to-noise factor of the signature.

14. A system for simulation comprising:

a user interface;

an atmospheric simulation module connected to the user interface;

a sensor radiation and response module connected to the user interface;

a cloud radiance and transmittance module; and

a synthesizer connected to the atmospheric simulation module, the sensor radiation and response module, and the cloud radiance and transmittance module.

15. The system of claim 14, further comprising a data storage module connected to the synthesizer.

16. The system of claim 15, wherein the sensor radiation and response module, the cloud radiance and transmittance module and the synthesizer are operated with a numerical computing tool.

17. The system of claim 16, wherein the numerical computing tool is a Matlab® module.

18. The system of claim 16, wherein the atmospheric simulation module is a MODTRAN module.

19. A signature simulator comprising:

an input stage;

a preparation stage;

a calibration stage; and

a simulation stage; and

wherein the simulation stage comprises:

a background spectrum;

an atmospheric model;



a cloud model; and

a simulated spectrum builder.

20. The simulator of claim 19 wherein calibration stage comprises:

computing an ambient blackbody spectrum;

computing a theoretical ambient blackbody spectrum;

and

computing a calibrated background spectrum.

21. The simulator of claim 20, wherein the calibration stage further comprises computing an LN<sub>2</sub> reference spectrum.

22. The simulator of claim 21, wherein the simulated spectrum builder may output a simulated signature.